



Western
Area Power
Administration

Vagaries of the river

Delivering reliable hydropower amid uncertain circumstances

Water-Energy Nexus Conference

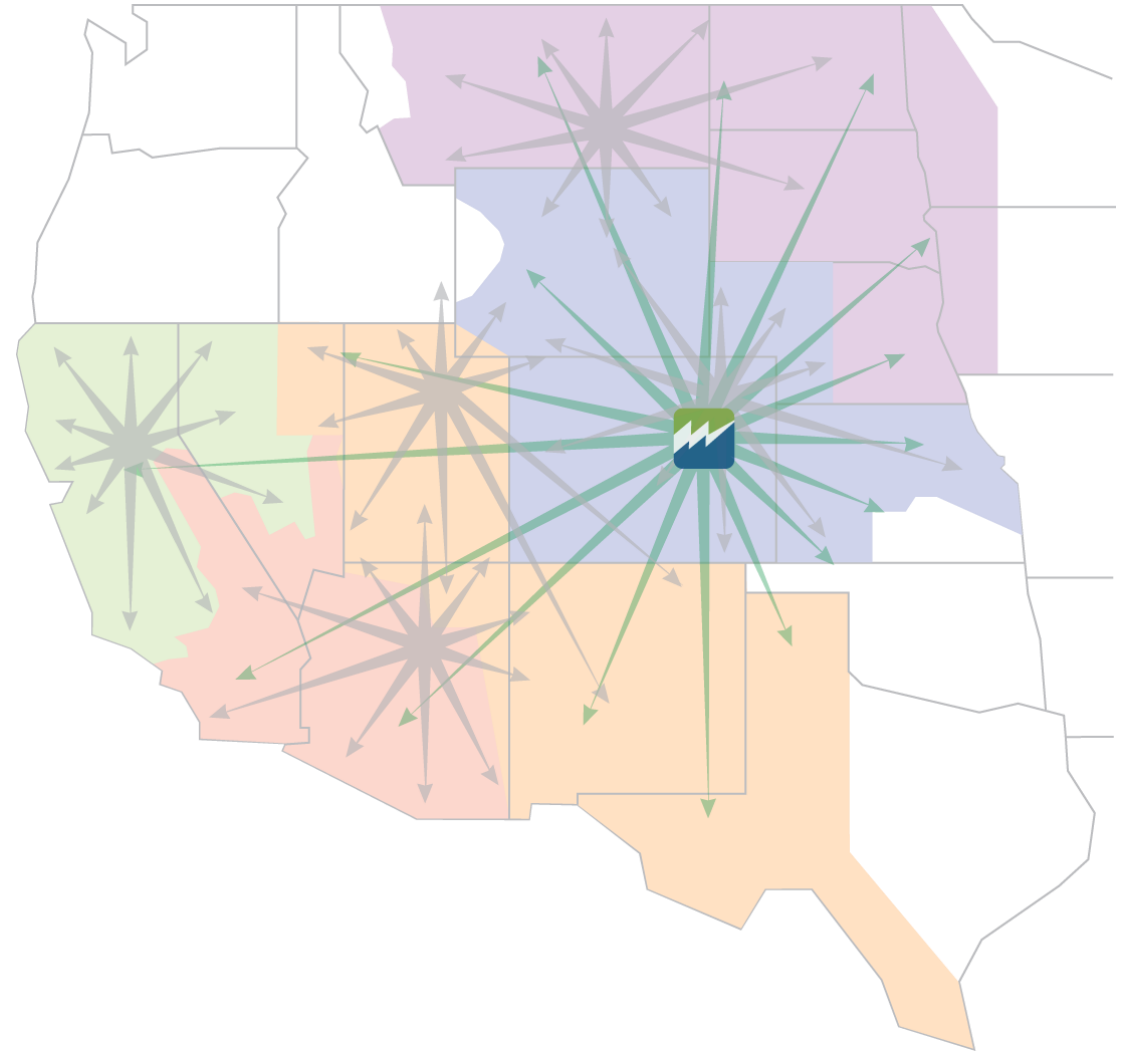
Mark A. Gabriel

Western Area Power Administration
Administrator & CEO

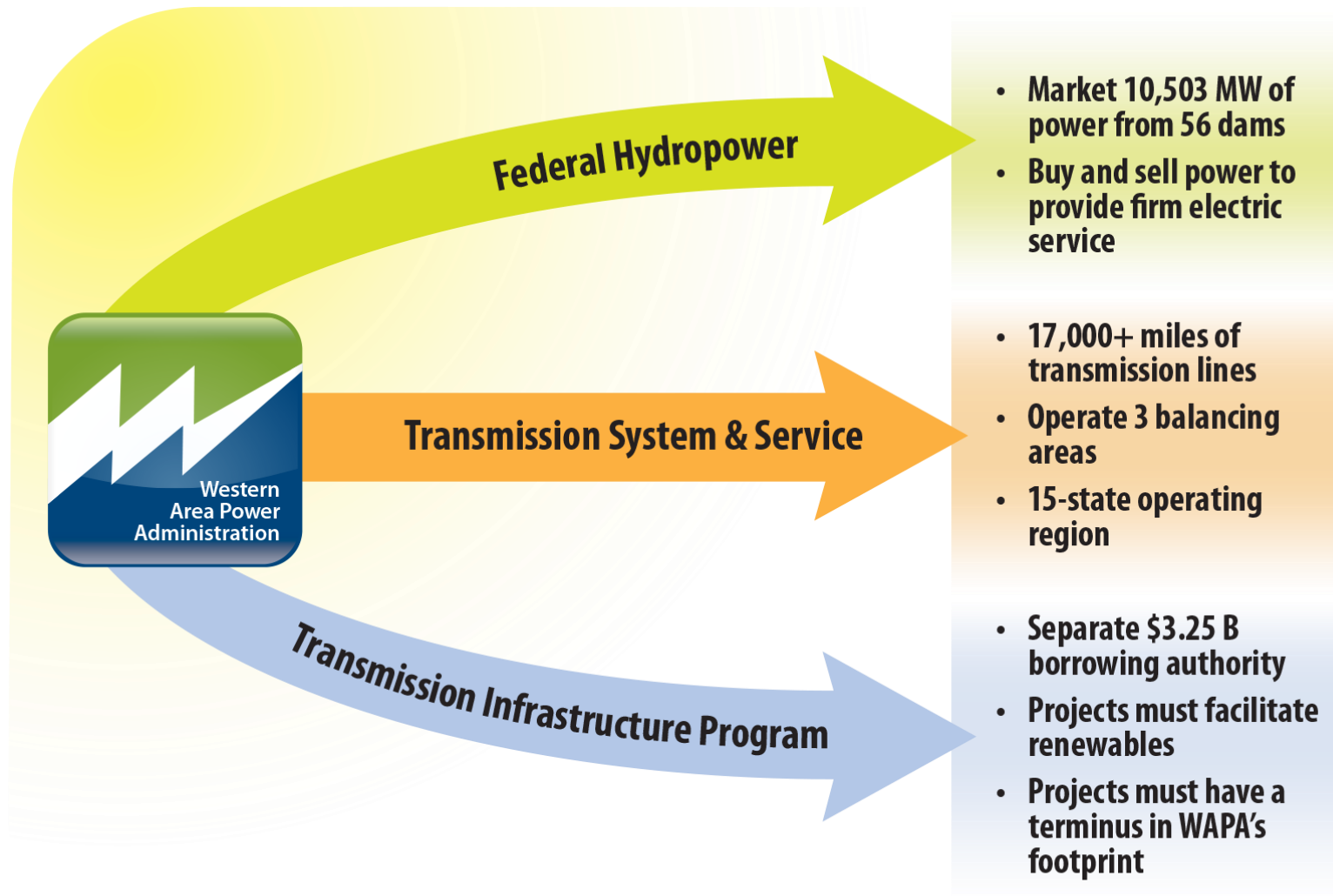
March 1, 2017
Los Angeles, California

Mission and vision

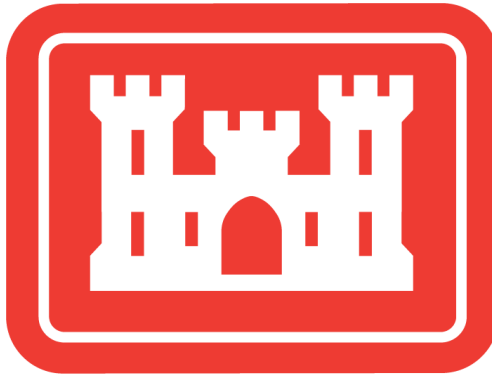
- Market and deliver reliable, renewable, cost-based hydroelectric power and related services within a 15-state region of the central and western U.S.
- Continue to provide premier power marketing and transmission services to our customers, as well as contribute to enhancing America's energy security and sustaining our nation's economic vitality



Three lines of business



Our power comes from



Vagaries of the river

Water interface: hydropower



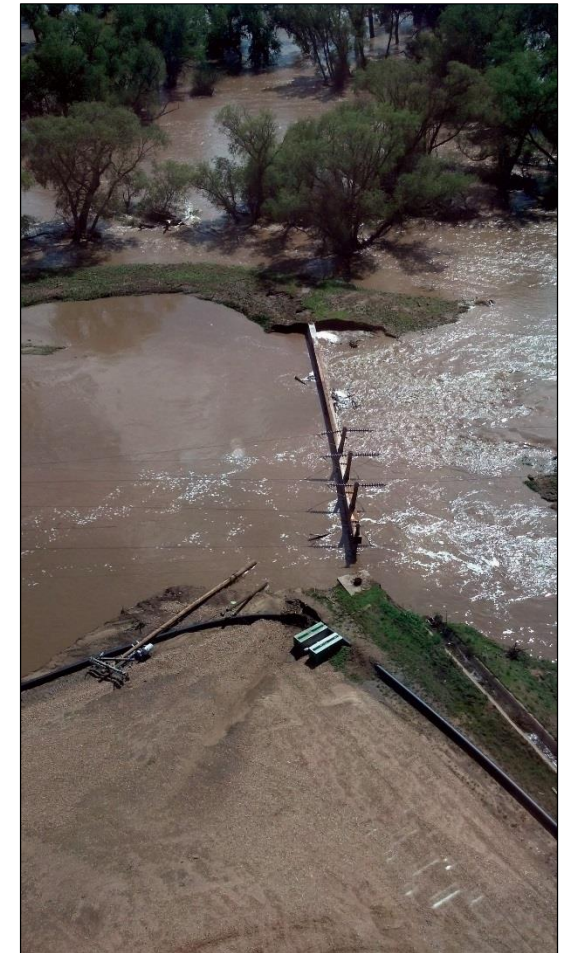
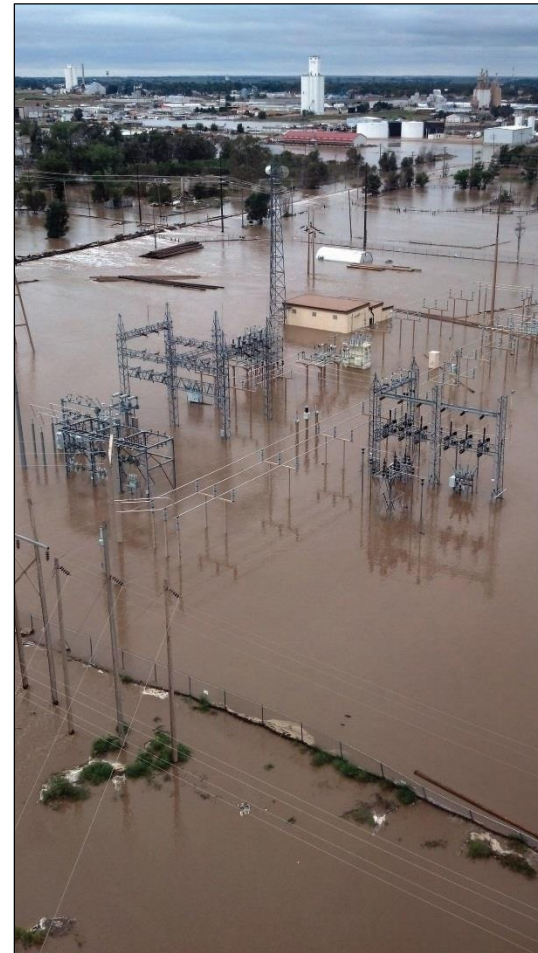
Photo by J. Carl Ganter / Circle of Blue

**75,000 dams in the U.S.
2,200 hydroelectric powerplants**



Vagaries of the river

Conditions across footprint - flooding



Conditions across footprint - drought

(Images by Planet Labs)

Folsom Lake

Left:

Oct. 26, 2015

Right:

Jan. 14, 2017



Vagaries of the river

Conditions across footprint – fire & ice



Oroville Dam, February 2017



(Photos by Mercury News)



Vagaries of the river

Oroville Dam, February 2017

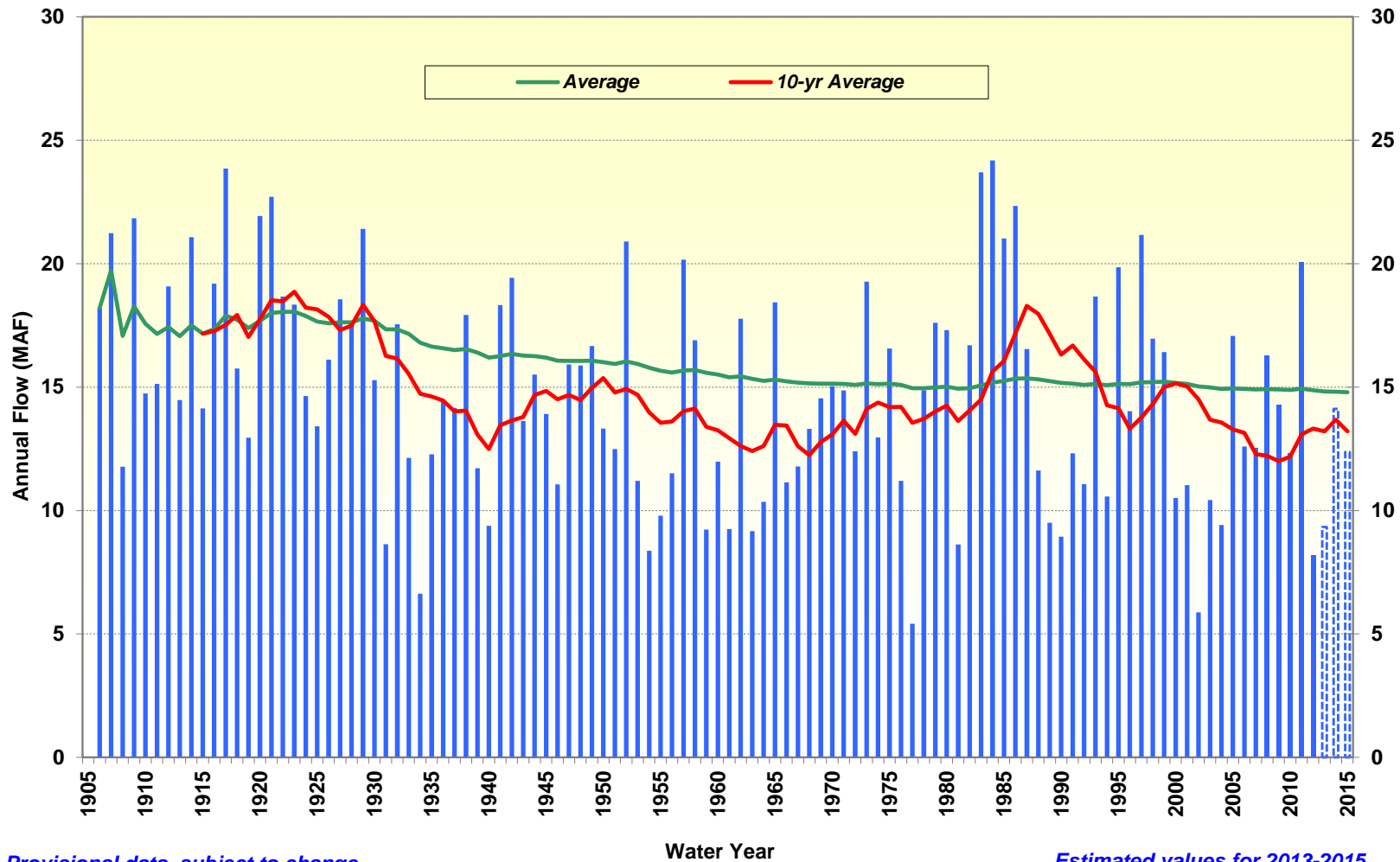


AP Photo/Marcio Jose Sanchez



Vagaries of the river

Colorado River at Lees Ferry, AZ



Provisional data, subject to change

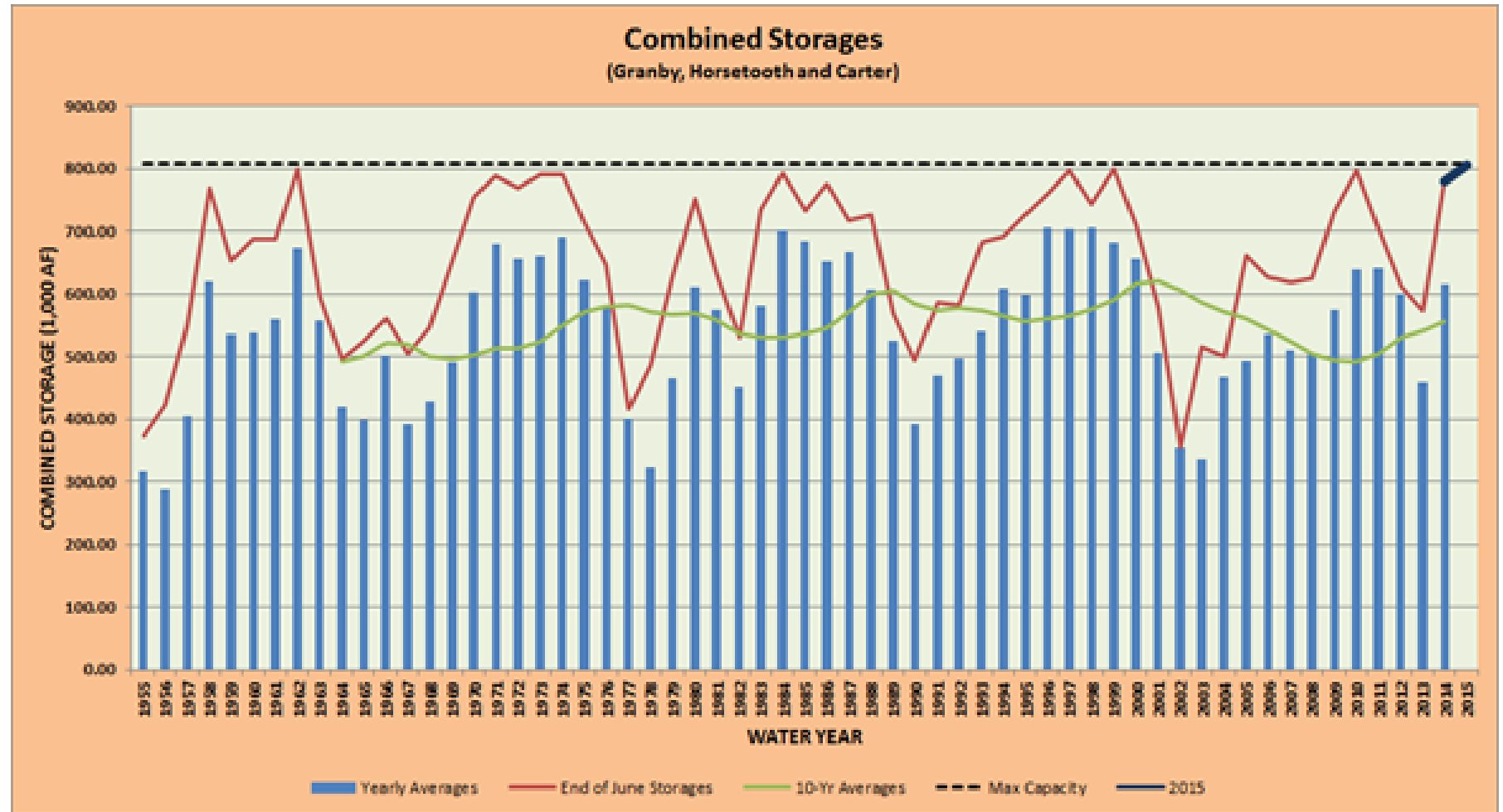
Estimated values for 2013-2015



Vagaries of the river

Colorado-Big Thompson

Annual
storage
averages



Vagaries of the river

Information and graphic provided by Bureau of Reclamation

Missouri River Basin Snowpack

February 6, 2017

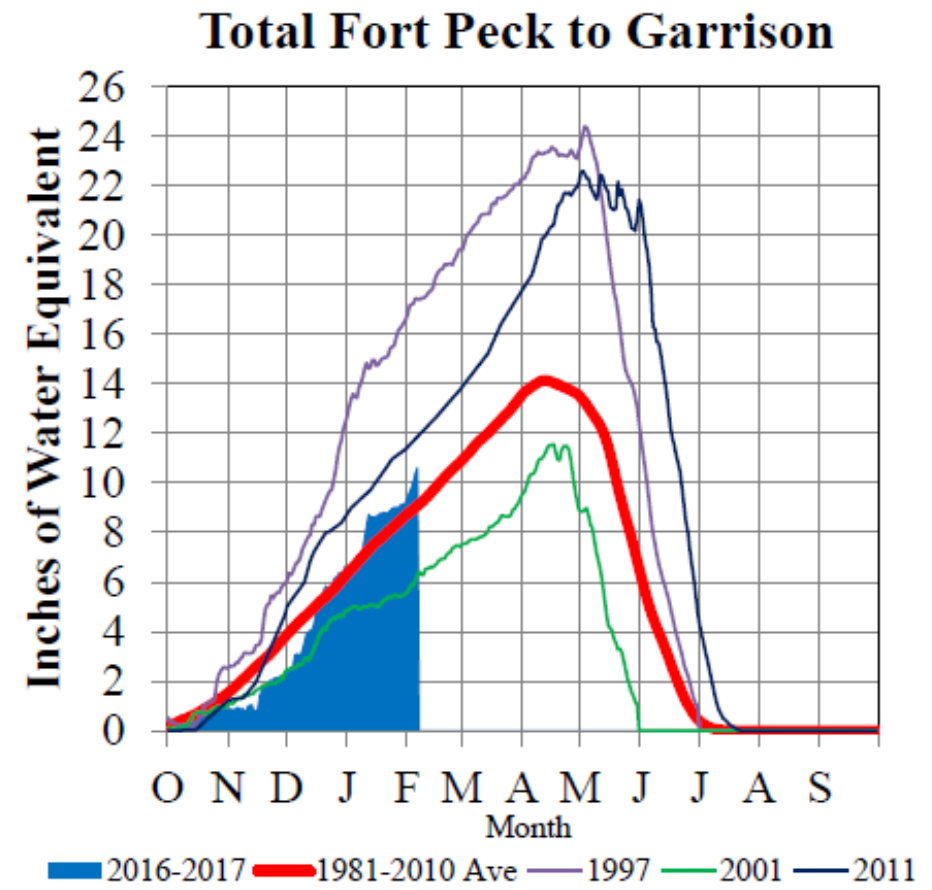
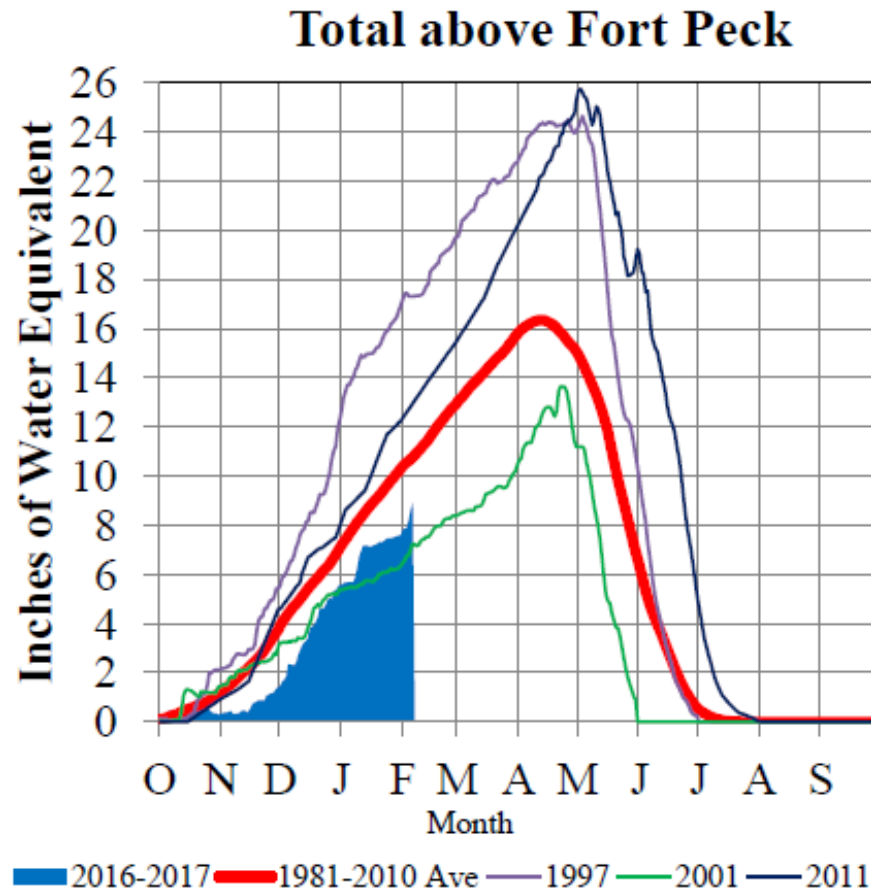
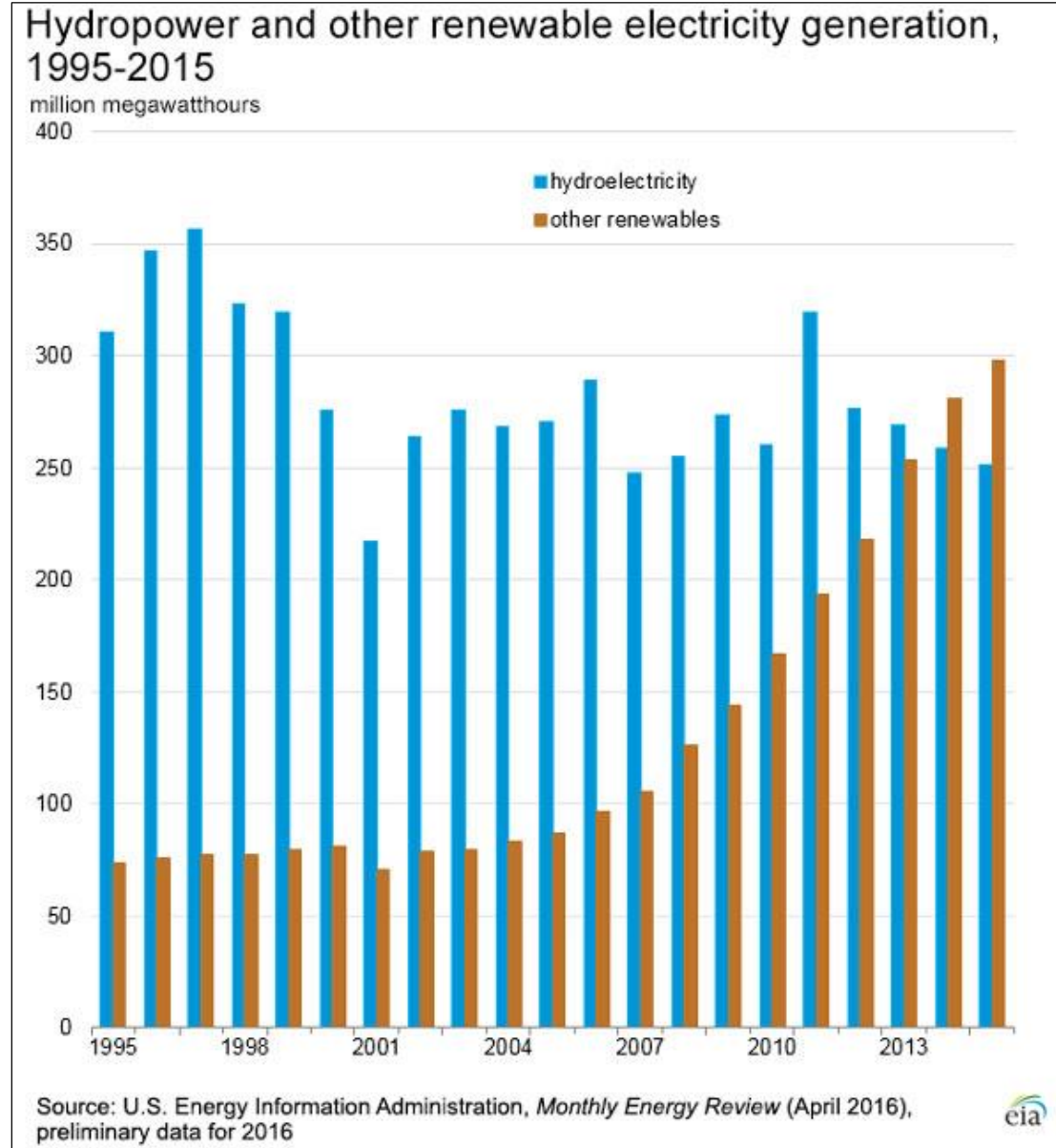


Chart provided by Army Corps of Engineers



Vagaries of the river

Hydro life in increasingly renewable world



Vagaries of the river

Pumped storage, another solution



WAPA markets energy from the Mount Elbert reversible pump-back unit in Colorado at Twin Lakes.



Regulatory environment

Acre Feet Bypassed from All GCD Experiments		
Number of Acre Feet Bypassed:	735,667	AF
Emissions if utilities use gas plants to make up for lost energy from Glen Canyon Dam:		
CO2 Emissions	375,741,920	lbs
SOX Emissions	33,105	lbs
NOX Emissions	562,785	lbs
Emissions if utilities use coal plants to make up for lost energy from Glen Canyon Dam:		
CO2 Emissions	744,531,787	lbs
SOX Emissions	4,303,652	lbs
NOX Emissions	1,986,301	lbs



What Do These Numbers Mean?		
CO2 output equals the annual air emissions from this many cars:		
Gas plant emissions equal:	33,199	cars driven for a year
Coal plants emissions equal	65,783	cars driven for a year

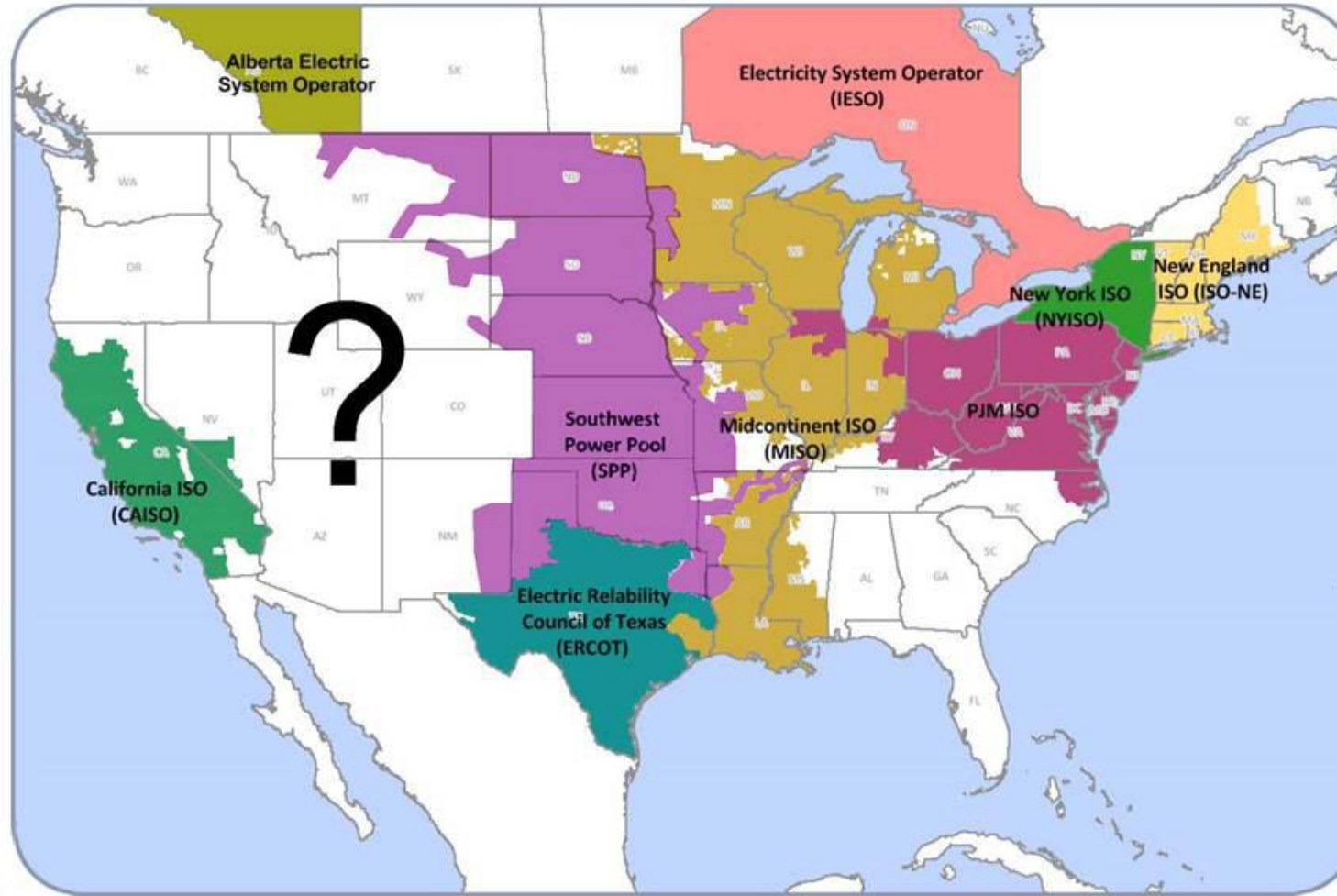


Chart courtesy of Salt River Project

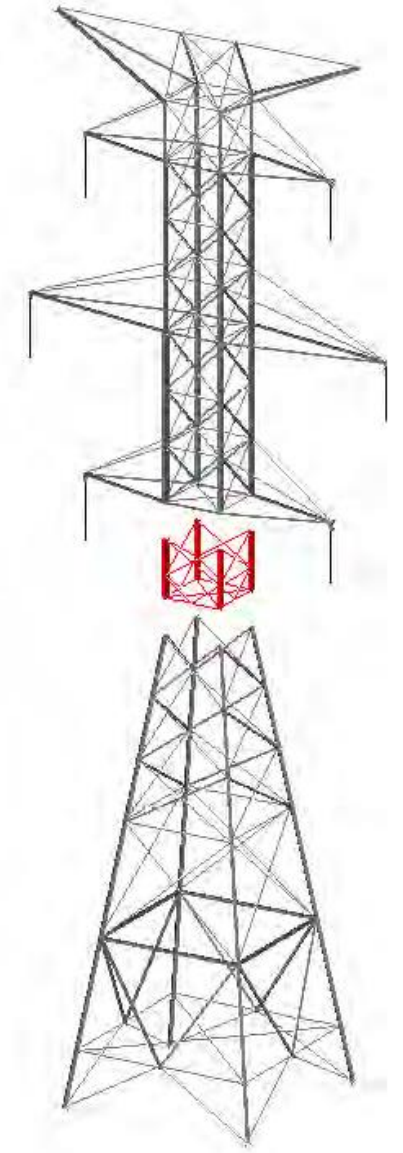


Vagaries of the river

Hydro's role in market environment



Balancing investment



Maintenance and Innovation



Vagaries of the river

Key takeaways

Though inextricably linked, the relationship between water and power continues to change. Partnership and innovation are key to maximizing the hydro resource.



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Photo by Bureau of Reclamation